

Server Type	Number of Switch Racks per Neighborhood	Number of Server Racks	Number of Network Connections per Customer/Server
Managed Services	2	14	3'
Co-Location	0*	18	1

Notes: Of which two of these connections are for management network connection.  
Because only one network connection is provided, the number of switch racks in a co-location technical suite is typically very small. These are commissioned separately from the server rack neighborhood.

**Table 3: Neighborhood Racking/Network Configurations**

Intel offers a variety of products designed to provide high reliability and flexibility in the data center:

#### Intel® ISP1100 Internet Server

Engineered for quick, high-volume deployment, the ISP1100 rack server features a high-density 1U design. Support is provided for either the Intel® Pentium® III or Intel® Celeron™ processor, so performance can be scaled from less demanding to more robust applications. This is an ideal platform for dedicated hosting.

#### Intel® ISP2150 Internet Server

With support for up to two 700 MHz Intel® Pentium® III processors, the 2U ISP2150 provides the performance needed for demanding Internet applications such as secure Web and CGI scripts. The ISP2150 can be clustered, load balanced and managed from a central console.

#### Intel® NetStructure™ 6000 Switch

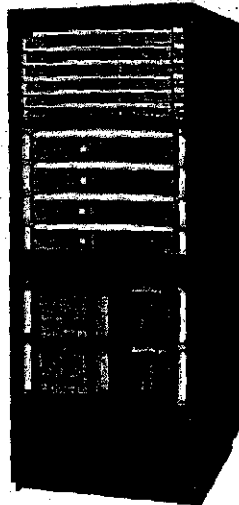
A high-density gigabit and fast ethernet data center switch, this product is designed for maximum reliability when aggregating servers. It includes redundant fans, power supplies and control processors.

#### Intel® NetStructure™ 480T Routing Switch

A medium density gigabit and fast ethernet data center switch. Traffic shaping features enable the service provider to control the bandwidth going to and from servers. Customers can pay depending on the amount of bandwidth they require.

#### Intel® Express 550T Routing Switch

Low-density fast ethernet data center switch. Transparent cache switching feature allows the service provider to cost-effectively integrate Cache Appliances at a fraction of the cost of a traditional layer 4 switch.



Within the data center, the network infrastructure should be based on Gigabit topology, which offers scalability, resilience and manageability. Another proven technology, ethernet is economical, highly scalable (10/100/1000 MB) and has a large user base. This means there are many vendor solutions available, assuring competitive pricing and good quality equipment.

#### Rack Configurations

Within a technical suite, servers are located within racking neighborhoods. Each server within a rack is supplied with power and network connectivity. In addition, managed servers are provided with monitoring, management and backup facilities.

A neighborhood comprises a number of server racks supported by dedicated switch racks for network connectivity and a pre-defined number of network connections per server (for managed services) or per customer (for co-location services). The exact configuration for a neighborhood is dependent on the equipment being used. As referenced in Table 2 (page 6), it is important to note that highest-density rack-mount systems designed for the data center will offer the service provider better economies than traditional, general-purpose servers. Here, Table 3 provides

a general guideline for the ratio of server racks/ switch racks and network connections per neighborhood.

When evaluating server platforms, it is absolutely essential that they provide seamless interoperability with the operating systems, development tools and applications needed to run a successful data center. Since the Intel® Architecture offers a broadly compatible, open server platform, it is an ideal choice. Unlike proprietary designs, the flexible architecture of Intel® Internet servers provides a wide selection of choices at every level of the solution stack.

## Data Center Management and Operation

### Service Management Center (SMC)

The Service Management Center is the core of the data center facility, providing systems management for all managed services and monitoring for the network. Correctly set up and managed, the SMC provides first-level support (1LS) for all alerts, incidents and problems, first-level contact for customers with the data center, direct feedback to customers on incident and problem resolution and dedicated network management and monitoring.

The SMC should be located within the data center itself and staffed 24 hours a day, seven days a week.

During core hours, support should be provided as follows:

- SMC staff: incident and problem logging, first-level support/resolution
- Technical support staff: second- and third-level support

Outside of core support hours, the SMC staff should still provide initial logging and first-level support, with technical support staff providing second- and third-level support on an on-call basis.

In order to be effective, the SMC must be equipped with the following:

- Dedicated management and monitoring tools for all operational managed services (e.g. HP OpenView,<sup>2</sup> Ultracomp UltraFrame Works<sup>®</sup> or equivalent)
- Automated backup facilities for all managed services
- An on-line Call Management System (e.g. Vantive<sup>®</sup>, Remedy<sup>®</sup>, Quetzal<sup>®</sup>)
- An integrated Change Management/ Asset Management/Configuration Tool (e.g., Ultracomp Red Box<sup>®</sup>)
- If possible, integrated Call Management/Help Desk Management with Change Control (e.g., via Ultracomp Red Box or via a process management tool such as InformAction's Matrix<sup>®</sup> product)

### Service Monitoring and Maintenance

The major selling point for dedicated managed services is the ability to provide "package" standard service monitoring facilities and to offer customers more proactive monitoring and auto-correction of faults. This requires the deployment of the appropriate monitoring tools and software.

Basic monitoring allows the SMC to check whether the network or a server is up or down, to check the general health of the network in terms of parameters such as packet loss and to view all log files. Basic monitoring could also cover server metrics such as hard disk usage, CPU and memory usage! Incidents detected by this basic monitoring would then be entered into the Call Management System, allowing them to be resolved via the defined incident and problem management process.

Beyond the basic level, proactive monitoring and maintenance provides "value added" services to the managed service environment. Examples of proactive service include trends monitoring, automated responses to given conditions, new patches/service packs firewall monitoring for intrusions and input to the call logging system when required.

These services can be provided on a chargeable basis, with customers paying a monthly fee to have the tasks carried out over and above the basic monitoring package. Or, customers could pay for them on an ad-hoc, fixed-price basis (i.e., all tasks are charged at a minimum of \$200 per hour).

<sup>1</sup>In order to ensure high quality managed services, the ability to monitor and control data center operations should extend to the server hardware itself.

<sup>2</sup>OpenFile was originally developed as an activity monitor utility to provide a quick and convenient means of identifying all open files on a VS system. The application has been greatly extended to run on most operating system platforms to provide a means of ensuring open files are safely backed-up.

### Customer System Backups

Backups should only be provided for Managed Services. Furthermore, in order to be effective, it is essential that any backup solution deployed is capable of backing-up files and tables that may be open at the time the backup is made. To this end, it is recommended that a product such as OpenFile<sup>®</sup> be evaluated as a part of the backup solution.

### Storage Area Networks

The typical computing environment, in which the backup media is provided on a per-server basis, lacks the flexibility and scalability required when transparently backing up vast quantities of data for a cross-section of clients. Therefore, alternative methods of secure, transparent backup need to be implemented.

A relatively new approach to backing-up data, which offers significant advantages to the data center environment, is the Storage Area Network (SAN) solution. SANs are based on a network of fiber channels to facilitate high speed and switches connecting storage devices (i.e., disk arrays, optical disks, tape libraries) to servers on a many to many basis. In an Internet hosting environment, this requires the server to have two ports: a public port for Internet access and a private port for backups and management.

SANs have a number of advantages:

- Facilitates universal access and sharing of resources
- Supports unpredictable, explosive information technology (IT) growth

- Provides affordable 24x365 availability
- Simplifies and centralizes resource management
- Improves information protection and disaster tolerance
- Enhances security and data integrity of new computing architectures

### SAN and Network Attached Storage

SAN and Network Attached Storage (NAS) provide similar facilities. The key differences can be summarized as:

- Storage Area Networks enable multiple servers to share central Fibre Channel RAID storage for higher performance, lower management cost and provide unlimited capacity growth. As stated above, SANs usually have dedicated network connectivity
- Network Attached Storage provides direct ethernet attachment of RAID storage without any disruption or downtime to existing servers

### Problem Management, Configuration Management and Change Control

Problem, configuration and change management are vital to the successful implementation of any managed service environment.

- Problem management, through the implementation of a Call Management System (CMS), enables the Service Management Center to log, track and resolve incidents either as they occur or as customers report them

- Through the implementation of a Configuration Management Database (CMDB), an Internet data center can baseline build configurations (hardware, operating system and software) of all managed services. Updates and changes to individual configurations can be tracked
- Change Management enables correct logging and implementation of hardware and software upgrades, changes to the operational parameters in the data center and changes to monitoring services. This ensures that there is minimal impact on current services or to customers

Problem, configuration and change management are closely interrelated, as illustrated by the following example:

A customer reports an incident—a server is not responding. The call is logged via the CMS and attempts are made to resolve the incident, but changes are required to the server. The incident then becomes a problem that may impact other servers as well. The problem is rectified, and as a result, a change is logged in the Change Management System recording the fact that the configuration of the affected server has been updated. The change is used to update the relevant server details in the Configuration Management Database. At the same time, the CMDB is interrogated to find out if other servers may be affected by the problem and need their configurations changed. These servers can then be updated.

Because of the way they are inter-related, and given the fact that correctly implemented problem and configuration management are a major plus in selling managed services, it is recommended that:

- Adequate planning should be given to the provision of all three (problem management, configuration management, change management)
- All three should be linked as closely as possible via their supporting software, the CMS and the CMDB
- All three should be implemented to standards such as those set out in the OCTA IT Infrastructure Library (ITIL)

## Data Center Organization

### *Structure*

Data center management can be divided into two key areas, production and development.

Production is the actual provision of services to customers from the initial sales contact through the implementation and monitoring of services. The production staff is responsible for:

- Managing the pre-sales process to ensure customers receive a service they require
- Managing current product portfolio
- Advising the development staff on emerging requirements from customers
- Building servers to current configuration standards

- Installation and implementation of new customer services
- Managing and maintenance of implemented services
- Providing first-level problem management
- Providing customer support

Development is defined as the ongoing tactical and strategic development of products and infrastructure to meet the demands of an evolving marketplace. The development staff is responsible for:

- Defining product baseline build configurations
- Product development in conjunction with the pre-sales process of the production staff
- Deployment and integration of new products
- Defining, testing and deploying tool sets for use by the SMC and support staff
- Network infrastructure management
- Management strategy definitions including backup strategies and disaster recovery strategies
- Providing second- and third-level problem management

As shown in Figure 2 (page 13), the production and development areas are closely interlinked by a number of processes. One of these processes is problem management. Production staff provides initial support such as logging calls and giving customer feedback, plus first-level support through

the Service Management Center (SMC). Development staff provides second- and third-level support via a call escalation process for those problems that cannot be resolved by the SMC.

Other processes where the two areas are interlinked include change management and configuration management. Development staff defines the baseline configuration standards for server hardware, operating system builds, software toolkits, network infrastructure and connectivity.

This information is entered into the Configuration Management Database, and individual updates to specific configurations are then made to the CMDB as Production support and maintain services in the "live" environment. Change management is the control tool to ensure all configuration changes are trapped, recorded and implemented.

Still another area is support and integration. Development staff defines the tactical and strategic development of data center tools and then provides the specialization and support needed to implement new technologies into the production environment, working in close co-operation with the Service Management Center.

### *The Production Environment*

The production environment is subdivided into three areas: pre-sales, project management and the Service Management Center.

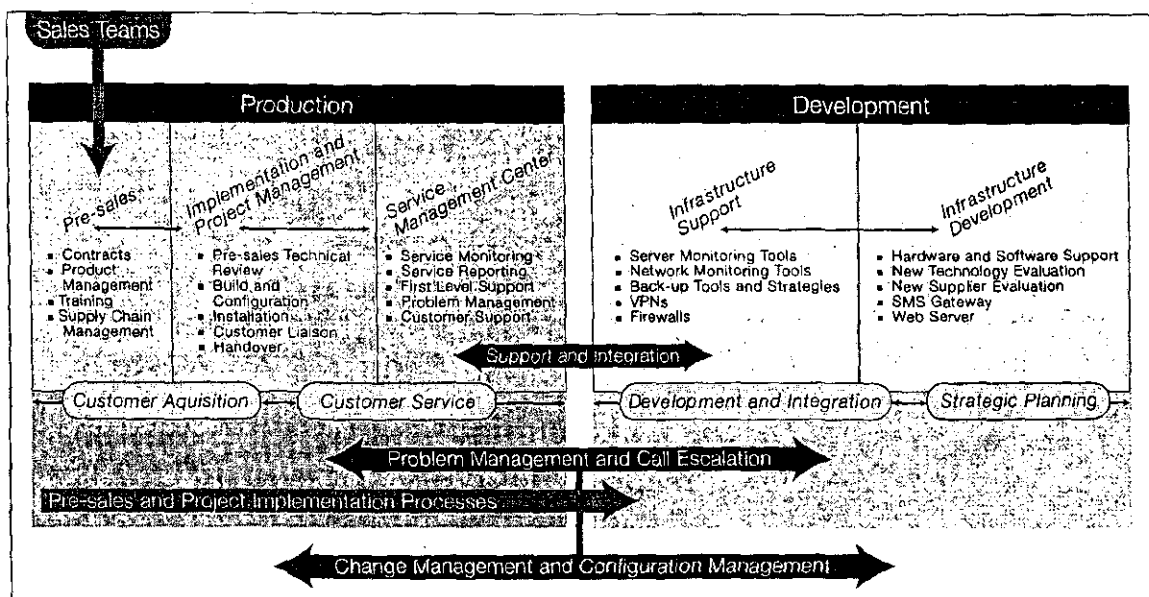


Figure 2: Internet Data Center Organization

Pre-sales is a vital function that provides a direct link between the sales force responsible for obtaining new customers and the technical staff responsible for providing services to those customers. Frequently, potential customers request services that are beyond the standard managed service provided by a data center. The role of the pre-sales area is to capture such requests from the sales force and ensure adequate technical input is given to a potential customer's requirements before any sale agreement is made.

There are several benefits of this kind of approach:

- Customers are not "sold" solutions that cannot be easily met by the data center
- The data center is able to judge customer requirements on a case-by-case basis and assess whether

it is cost-effective to update the standard managed services to include frequently requested items

- The sales force is not required to undertake a technical evaluation of a potential customer's specific requirements—instead, the sales force can request assistance from technical pre-sales staff

While the development environment has overall responsibility for defining the services supplied by the data center, implementing those services on behalf of customers is a specialized task requiring the services of a dedicated implementation team of engineers. This implementation or project management team has the responsibility of:

- Building services to the required specification
- Updating the CMDB as new builds are completed

- Implementing new services for customers
- Handing over new services to the Service Management Center

The most efficient way to implement services for new and existing customers is to handle them on a project basis. Each service or customer is classified as a distinct project overseen by a technical project manager. This project manager stays in contact with the customer during the build and implementation process, allowing the implementation engineers to concentrate on building, testing and implementing the required servers and services.

The pre-sales and project implementation processes govern all work to implement customers and services within the production environment. These processes, which should be developed to a defined standard, specify all the required steps

that must be followed in order to successfully sign up a customer with the data center and then implement the services the customer has purchased. There should be a logical flow of information from the pre-sales environment, through to the hand-over of a service to the Service Management Center.

Hand-over Documentation for each customer is one of the final steps in the implementation process. This document should include:

- Support and contact information
- Service description
- Hardware and software configuration
- Password and access control information
- Standard service monitoring and maintenance (managed services only)
- Incident and problem reporting procedures (managed services only)
- Backup methodology (managed services)
- New software installation guidelines (managed services only)

The Service Management Center must be staffed 24 hours a day, seven days a week throughout the year. Staff will therefore be required to work a shift pattern, and a suitable shift system must be established. Since the SMC will provide initial incident investigation and resolution, the staff employed need to have a thorough understanding of the systems and services supplied by

the data center. Preferably, they should also be familiar with the customers they will be dealing with.

Implementation and support staff will not be required to work shifts, but will be required to provide second- and third-level support. Therefore, staff employed in these areas will be required to work on an on-call rotation.

### ***The Development Environment***

The development environment is subdivided into two areas: infrastructure support and infrastructure development.

Infrastructure Support Staff is responsible for integrating products and technology into the current production environment. This staff also has responsibility for providing second-level support to the Service Management Center to resolve incidents and problems via the problem management process.

Infrastructure Development is the area that evaluates emerging products and technology and reviews new standards for their benefit to the data center. This area also provides the highest level of support, third-level, for all hardware and software implemented within the data center. Technologies evaluated and approved for use within the data center are passed to the infrastructure support group for integration into the data center, with support from the development team.

## **Conclusion**

If customers are to outsource their mission-critical Internet operations, they expect a physical and technical environment that offers the highest levels of reliability and flexibility. Accordingly, the Internet data center must provide the physical environment, network connectivity, technical skills and server hardware necessary to keep Internet servers up and running 24 hours a day, seven days a week.

### ***General***

Establishing and operating an Internet data center requires a high degree of planning and implementation, not just to ensure the integrity of the data center environment itself, but also in the definition and integration of the supporting infrastructure—sales teams, sales support, customer support, etc.

One key to establishing a successful data center must be that of scalability. Facilities do not, in the first instance need to be large—but they do need to offer the potential for rapid growth.

### ***Product Balance***

Careful consideration must also be given to the balance of products—Managed Services against Co-locate services; customized managed services against "off-the-shelf" Managed Services, where all the support elements, etc., are pre-defined.

Co-locate services offer a quick means to earn revenue—the racking space, power and network link can be charged at a premium, but there is no overhead incurred in maintaining the services.

Managed Services offer the most constructive way of generating income, especially if a range of e-Commerce applications can be supplied to clients as a part of the baseline service, providing them with a value-added resource.

### ***Integration***

As defined in this white paper, the real secret to success within the Internet data center/ASP environment is that of integration. It is not sufficient to have a robust set of products (servers and software) and an environment in which to operate them. A successful data center implementation is one that presents customers with a seamless, fully-integrated environment—from the initial point of sale, through to on-going management and support.

The data center market is still relatively young, and demand is growing. Intel has a product and services suite that is ideally suited to the ISP/ASP hosting environment, offering as it does a flexibility of approach and implementation that can be used to structure a market-leading set of services for potential customers and clients. By combining these types of products with operational recommendations as given throughout this white paper, service providers can successfully meet the challenges presented by today's rapidly changing and competitive marketplace.

### **For More Information**

For more information about the emerging e-Business data center, visit:

<http://www.intel.com/network/e-Business>

Intel offers a comprehensive range of products designed to provide maximum flexibility for data center environments.

To learn more, see:

<http://www.intel.com/network/products>

Intel ISP Program provides dedicated resources and Internet-focused solutions that can help you grow your business.

Sign up today at <http://www.intel.com/isp>.



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# Home is where the network is

Jacques R. Bughin, Renee C. Foster, Alan Miles,  
and Luis A. Ubiñas

During the next few years, home networks will leap off the pages of science magazines and into the households of millions. But who will pay, and how?

**E**ver since the Internet entered the popular culture, futurists and technophiles have been telling the world that the new medium would transform homes into information-rich hubs of activity. Refrigerators, they predicted, would someday monitor the expiration dates on milk cartons. The family room would double as a videoconferencing theater. The toaster and the microwave would engage in endless Socratic debate.

Three or four years on, none of this has happened, and some of it may never happen, since consumers are likely to see many gee-whiz applications as more trouble than they are worth. Yet home networking is far from dead: in the past three years, the underlying technology has undergone its own quiet revolution. Big interests are at stake, and companies such as Intel, Microsoft, and 3Com have been diligently working out the bugs; others, including Cisco, Ericsson, and Pace, have been testing the new technology in homes to see how consumers react.

Such companies have found that although talking toasters may remain a fantasy, people would even now be willing to use more prosaic applications that make it possible for them to communicate more easily, to find a broader

range of entertainment options, and to assume greater control over their homes. Clearly, the major broadband providers—of both cable and Digital Subscriber Line services—should be extremely interested in home network-

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Any business interested in home-networking technology should be **formulating its strategy now**

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ing. So should the makers of consumer electronics gear, personal computers, computer games, and network software.

Indeed, the current demand for simple, nuts-and-bolts applications

may already be strong enough for broadband providers to think not only about including home-networking hardware in their installation packages but also about doing so free of charge. And if companies in a major industry have an economic incentive to supply the consumer with this equipment at their own expense, any business with an interest in the technology should be formulating its strategy right now.

### Running the numbers

The hardware and software that enable devices in a home to share voice, video, and data can reside in a stand-alone unit or be incorporated into DSL modems, cable set-top boxes, PCs, and other devices. The equipment either broadcasts short-range radio signals or sends data over telephone or electrical wires, thus reaching appliances and computer peripherals throughout the user's home.

Software developers, including Microsoft and Sun Microsystems, have created protocols that make it possible for devices ranging from refrigerators to laser printers to recognize and understand one another. Meanwhile, during the past two years, semiconductor companies such as Broadcom, Intel, and Lucent Technologies have introduced new integrated circuits that provide for this type of network, using only radio frequencies already allocated for such purposes or the wires already installed in the walls of homes. The capabilities of these chips have increased dramatically: current models can move 10 megabits of data a second through telephone lines or the air, and fairly soon top speeds are expected to reach 32 megabits or more—enough to deliver several DVD-quality audio and video signals simultaneously.<sup>1</sup> Most manufacturers of computing devices and home appliances plan to start putting home-networking chips into their products this year. If the trend continues, in three to five years the inhabitants of the developed world will wake up one day to find their homes network enabled, much as they found their television sets equipped with remote controls a decade ago.

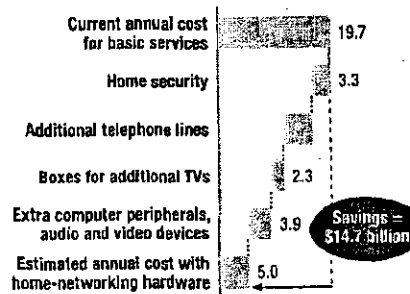
<sup>1</sup>One chip set likely to be produced commercially this year can send 10 megabits of data a second over any home's electrical wires, without interfering with the delivery of power.

To understand the strength of the economic case for deploying home-networking equipment free of charge to consumers, consider only the most basic, nuts-and-bolts applications: services that people pay for today even without home networks but that become much less costly delivered through them. For example, a home network could easily link two or more computers in a home—a job that would otherwise require a technician to go there and install an Ethernet card and a local-area network. When all the computers in a home talk with one another, they can share printers, scanners, and a single Internet connection, thereby realizing big cost savings in homes with a number of systems. Similarly, a home network allows a single set-top box to bring cable service to several TV sets, eliminating the cost of extra boxes. A third basic service is the installation of extra phone lines in homes that have at least one. Home networking makes the job much less costly by allowing new phone jacks to plug in to standard electrical outlets and by creating virtual fax numbers or second phone lines on demand.

Finally, a particularly interesting home-networking application: home security and control systems, such as standard burglar alarms that call the police in the event of a break-in. Installing a system of this kind now requires you to add a whole new loop of wiring in your house, as well as extra hardware to detect intruders and to notify the police. With a home network, you could set up a home security and remote-control system using only a few pieces of equipment (cameras and motion detectors, for example) that plug into the walls. The cost savings can be huge, and you can add more sophisticated services than you could with a standard alarm system—for instance, the ability to let a repair person into your house even if you happen to be at the office.

Assuming current levels of demand, we estimate that in the United States alone, home networking would cut \$14.7 billion from the cost of hardware, installation, and upkeep if it were applied only to in-home computer networks, cable service to additional TVs, additional telephone lines, and home security systems (Exhibit 1). And that figure is merely the average cost savings multiplied by *current* demand; it makes no allowance for the higher demand that would likely result if prices fell. Even so, the savings amount to at least \$140 a year per US household, on average.

## EXHIBIT 1

**The savings behind the science**Annual savings potential from home networking,<sup>1</sup> \$ billion<sup>1</sup>For the United States.Source: Federal Communications Commission; Forrester Research; *Security Distributing & Marketing* magazine's industry profile, 2000; McKinsey analysis

In fact, any consumer can enjoy some of the benefits of home networking right now, for a one-time cost of \$300 to \$400, by purchasing a stand-alone home-networking box. But home owners are reluctant to spend such large sums for benefits they still consider highly speculative.

Cable and DSL companies, however, are in a particularly good position to provide those benefits on their own. For them, adding the appropriate hardware to new cable set-top boxes or DSL modems would involve a one-time

cost of only \$40 and \$108, respectively. In view of the possibility of

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Cable and DSL providers could put home-networking chips in their equipment and install it in homes **exactly** as they plan to do now

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saving \$140 per household, installation clearly makes sense from the perspective of overall economic efficiency. In most developed countries, both cable and DSL providers are just beginning to ramp up new

hardware installations. Over the next five years, roughly 40 percent of US homes will acquire digital set-top boxes or DSL modems. To deploy home networks, cable and DSL providers could include the necessary chips in their new set-top boxes and modems and then continue to install the equipment exactly as they plan to do now. Broadband providers might therefore make an ideal conduit for bringing home networks to the mass market.

### **Lower churn, better penetration, higher fees**

Of course, not every product that creates efficiencies comes to market. To finance the installation of home-networking gear, the broadband companies will have to find a way to capture at least some of the money it saves. If all of the money goes into the pockets of consumers, the deployment of home networking may have to wait until they are willing to pay for it—and that probably won't happen for several years.

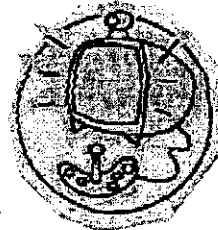
With this in mind, we asked ourselves how broadband companies could benefit from providing home-networking hardware to consumers free of charge. The first way might be higher average revenue per customer. People who use a home-networking security system instead of a traditional burglar alarm, for example, may be willing to split the cost savings with the broadband provider by paying monthly service fees that incorporate some but not all of the savings. Such people might also be willing to pay for ancillary services, such as a "nanny surveillance" camera, on the same system. Most important, home networking greatly increases the value of the new video, voice, and data services a provider might make available, since they would

no longer be tied to a single room. Consumers might be willing to pay for that sort of convenience.

A second possible benefit to broadband companies would be a reduction in the rate at which users cancel services—either by giving up broadband entirely or by switching to other providers who supply it along with telephone and cable-TV service. As people come to rely on their broadband provider not only for high-speed Internet access but also for services such as computer networking, they will presumably have more reasons to stick with that company; dropout rates (or churn rates) should therefore decline. Finally, the services available through home networking are likely to attract more customers, increasing the penetration of broadband generally.

### Doing the math

Improvements in three metrics—monthly fees, churn rates, and penetration rates—would be needed to justify giving subscribers free home-networking equipment. We looked at all three. First, we put ourselves in the shoes of a US cable provider such as AOL Time Warner or Comcast. Whenever these companies undertake a broadband or a digital-TV installation, they leave a \$250 digital set-top box, for which they themselves pay, in the subscriber's home. As we have seen, incorporating a home-networking capability into those new boxes would cost the cable company an extra \$40, with essentially no increase in the cost of installation.

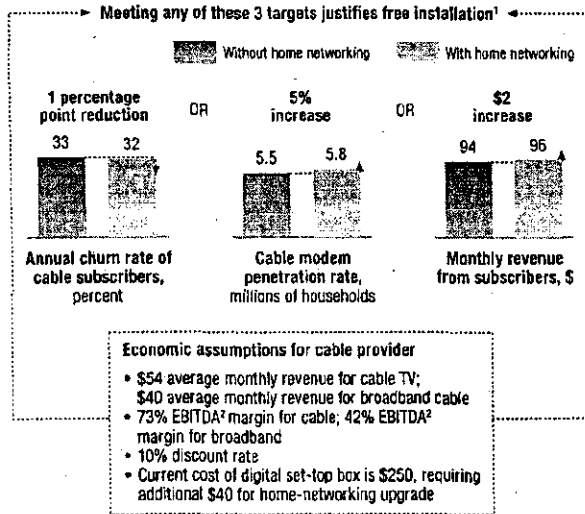


US cable providers could make money including home-networking equipment in their digital set-top boxes at their own expense if the extra features cut the annual churn of cable subscribers by only 1 percentage point (to 32 percent, from 33) or increased the cable modem penetration rate by a modest 5 percent (to 5.8 million US households, from 5.5 million) by the end of 2001.<sup>2</sup> Alternatively, if home networking delivered extra fees of just \$2 a month on average, free installation would make sense even with no change in the churn or penetration rates. Furthermore, any combination of the churn rate, the penetration rate, and average revenue might be enough to justify free installation even if none did so on its own (Exhibit 2, on the next page). The message is clear: for cable providers, the time to provide home networking free of charge may have arrived already.

<sup>2</sup>A drop in the actual cable churn rate to 32 percent, from 33, would increase the length of an average consumer's subscription by about 1.3 months. This would generate enough earnings to cover the extra \$40 cost of the required hardware, assuming an average cable bill of \$54 and margins of 73 percent and also assuming that the savings were realized at the end of the customer's subscription.

## EXHIBIT 2

## The case for cable: Free installation makes sense now

<sup>1</sup>For cable providers in the United States.<sup>2</sup>Earnings before interest, taxes, depreciation, and amortization.

Source: Jupiter Communications; Paul Kagan Associates; McKinsey analysis

For DSL providers, such as Verizon Communications, BellSouth, and Telocity, the economic case, though not quite as strong, is still impressive. Adding a home-networking capability to a DSL modem costs the provider an extra \$108. If the added functionality reduced the yearly churn rate of all telephone subscribers (long-distance, local, and DSL) by 2 percentage points (to 22 percent, from 24), that extra revenue alone would justify free installation.

Even if the churn rate didn't drop at all, an 8 percent increase in DSL penetration—to roughly 2.7 million US households, from 2.5 million, as of this coming December—would also make free installation a winning strategy. The same would be true if the average user paid \$4 more a month for home-networking services (Exhibit 3). All of these numerical targets, we think, are within reasonable ranges: most subscribers, for example, pay more than the required \$4 a month just for call-waiting, caller ID, and so forth.

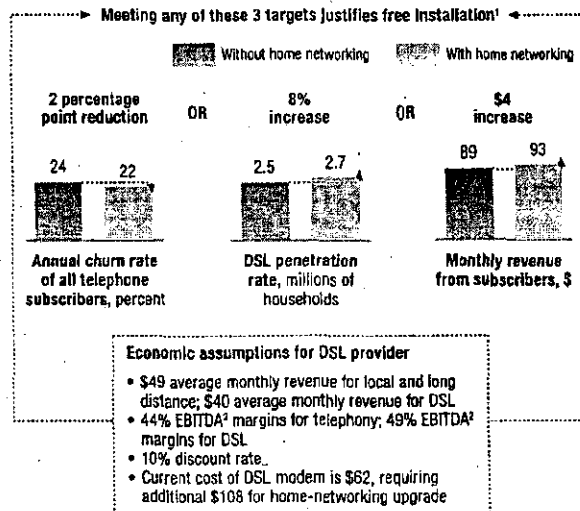
The case for free deployment is obviously a bit better for cable companies than for DSL providers. But when existing boxes are replaced by new ones equipped with home-networking gear, the economics on the DSL side improve. New cable boxes with home-networking chips cost providers \$290, while new DSL modems with them cost only \$170. DSL companies thus have a lower cost hurdle to surmount when they decide whether to replace existing broadband boxes with network-enabled ones.

### House of games

Apart from cable and DSL providers, only one kind of company has any serious thought of installing home-networking hubs in the home: game console

manufacturers, such as Sony, Microsoft, and, until recently, Sega. The penetration of game consoles in US households stands at about 40 percent. Indeed, each year more game consoles than personal computers are sold in the United States; players tend to buy new systems, capable of running the latest games, with each new generation of consoles. During the next four years, the game industry expects to sell some 81 million of them in the United States alone.

EXHIBIT 3

**The case for DSL: Free installation is a viable option**

<sup>1</sup>For DSL providers in the United States.

<sup>2</sup>Earnings before interest, taxes, depreciation, and amortization.

Source: Jupiter Communications; Paul Kagan Associates; McKinsey analysis

Consoles already hook into television sets and now often come with Internet access for remote game playing. Still, we don't see consoles as natural delivery mediums for home networks. Game makers would find it much harder than cable and DSL providers to undertake the necessary service and monthly billing. Moreover, broadband links to the Internet dramatically increase the usefulness of home networks, but game consoles are found mostly in homes that lack "always-on" Internet connections.<sup>3</sup>

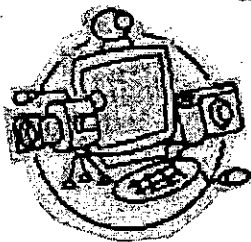
However, it does make sense for cable providers to ally themselves with game makers by installing game capabilities in their set-top boxes; doing so would raise the cost of a home-networked cable box by only \$40, to \$330. Indeed, deals between cable providers and game makers are already being struck. Cablevision, one of the more forward-looking major cable providers in the United States, has bought three million Sony set-top boxes, with an option to include Sony PlayStation platforms as they are deployed, and Sega

<sup>3</sup>PC manufacturers, which could bundle the necessary chip sets into their new systems, either as a standard feature or as an option, might also seem to be natural candidates to provide home-networking hubs. But for a number of reasons, these companies are much less likely than broadband providers to do so. For one thing, there is already a large installed base of PCs, whereas digital cable boxes and DSL modems are just starting to be installed. Besides, PCs are notoriously unreliable: you don't want your home network to crash every week.

has been licensing its gaming technology to manufacturers of set-top boxes. For years, game makers have sold their consoles at a loss, making up for it with software revenue. Perhaps they have at last found, in the cable providers, partners capable of getting their game chips into US television sets at a much lower cost.

### Thinking strategically

Clearly, cable and DSL providers, as well as game makers, should be thinking about their home-networking strategies right now. As they do, they will find themselves focusing on two major questions: how important will one-stop shopping in home data services become, and will computer games evolve away from stand-alone applications and toward games played remotely, over the Internet?



US cable providers, betting that customers will prefer to buy television and other data services from the same company, are making big investments to upgrade their networks. The advantage for the consumer is the ability to pay a single bill and to deal with a single customer service department. Cable providers, however, aren't known for service. How much worse would their reputation be if subscribers had to deal with them every time a computer printer wasn't responding or the nanny-cam went on the blink? In any case, consumers have so far apparently cared less about one-stop shopping than the cable providers had hoped—one big reason for the decision by AT&T, late last year, to spin off its vast cable assets.

The fate of "social gaming" complicates the question for cable players. If on-line fantasy games such as *EverQuest*, or smaller social games such as remote bridge or remote chess, take off rapidly, the game makers will have an added incentive to get their gaming platforms into set-top boxes as quickly as possible. Cable companies will be happy to oblige, since social gamers will likely purchase broadband service in large numbers.

Right now, the biggest decision that all cable and DSL providers have to make is whether to deploy home-networking equipment quickly or slowly. Industry economics, as we have seen, may support immediate deployment, but some players may want to bide their time. For instance, if either cable or DSL providers believe that they can distribute network-enabled modems much more quickly than the other can, the speedier group may want to hold off deployment: why place a bet early if you can afford to wait and see how events unfold? If the providers of one or the other technology believe that their current boxes are harder to retrofit than those of their rivals, that

would argue for moving more rapidly—before too many more non-networked boxes are installed. The strategic combinations are many, but the point is simple: the decision to move quickly or slowly expresses a company's beliefs about the strengths of the competing technologies and the evolution of consumer tastes.

One thing appears certain: in three to five years, home networks will have moved off the pages of science magazines and into millions of US homes. And millions of people, seeing a home network as a huge opportunity to save money and obtain valuable new services, will embrace the technology with enthusiasm—even if their toasters remain silent. MQ

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## **Free Home Networking Detailed in Ubicom Briefing Paper; Revenue From Customer Applications Will Entice Broadband Providers to Offer Free Home Networks**

MOUNTAIN VIEW, Calif.--(BUSINESS WIRE) via NewsEdge Corporation -- As the latest in its series of executive briefing papers, Ubicom, Inc. today announced the on-line availability of a paper, Free Home Networking -- Coming Soon, that discusses the potential for free home networking to be provided by broadband service providers. Ubicom is a leader in providing Internet Processors and networking software that enable ubiquitous communication.

Ubicom believes that TV cable, satellite-dish, DSL and other broadband providers will provide or underwrite free home networking for two economic reasons. First is their desire to lock-in customers ahead of growing competition. Second is the "pull" of current revenues from such applications as sharing of home computer peripherals, entertainment, home security and on-line interactive games. Such a strategy is a variation of the old razor blade marketing scheme of giving away the razor to make money selling the blades. The broadband providers will provide home networking to obtain on-going service revenues.

"The current situation is unusual because of the existence of in-place 'killer applications' simultaneously creating user demand and vendor revenue," said Stephan Thaler, vice president of Marketing at Ubicom. "Thus, giving away or underwriting the cost of home networking by the providers makes sense. We see home networks with a broadband access point as the next logical progression in networking."

The full case for free home networking is detailed in Ubicom's Executive Brief, Free Home Networking -- Coming Soon. The short, easy-to-read background document details the scenario and potential revenue that will drive free home networking. The document can be found on-line at [www.ubicom.com/news/executive\\_releases.html](http://www.ubicom.com/news/executive_releases.html).

Related information on home networking can be found on the Web at:

- Ubicom -- [www.ubicom.com](http://www.ubicom.com)
  - Bluetooth(TM) wireless technology -- [www.bluetooth.com](http://www.bluetooth.com)
  - Home Audio Video Interoperability (HAVi) -- [www.havi.org](http://www.havi.org)
  - HomePhoneline Networking Alliance (HomePNA(TM)) -- [www.homepna.org/index.asp](http://www.homepna.org/index.asp)
  - Universal Plug and Play (UPnP) -- [www.upnp.org](http://www.upnp.org)
  - HomePlug(TM) -- [www.homeplug.org](http://www.homeplug.org)
- Ubicom, Inc.

Headquartered in Mountain View, Ubicom, Inc. enables ubiquitous communications. Ubicom is the leading supplier of Internet Processors and protocol stacks that will connect billions of devices to the Internet. Ubicom implements communications and control functions as pre-built software modules that run on the Internet Processors. This approach reduces time to production and system cost, while providing greater flexibility, compared to traditional design approaches.

Additional information on Ubicom and its products can be found on the Web at [www.ubicom.com](http://www.ubicom.com).

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## Consumer Market Convergence

REPORT Vol. 18, No. 2—February 2001  
by Karuna Uppal

# Shopping for a Home Network

## Executive Summary

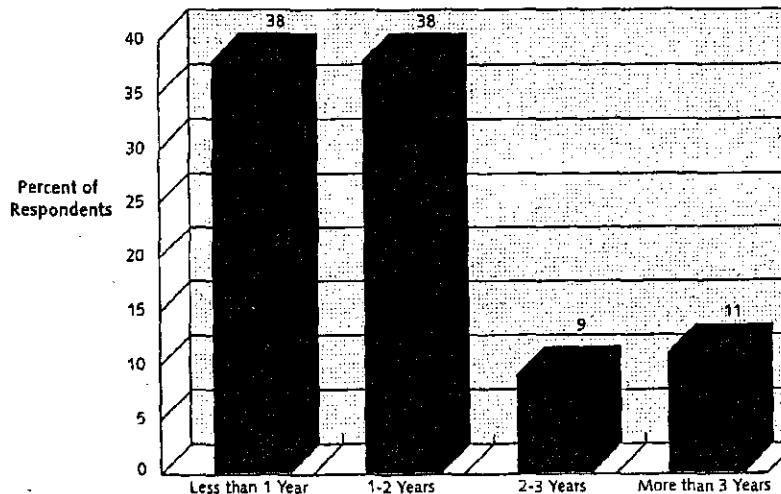
At the end of 2000 there were over 2.5 million U.S. households with a home network, and the fact that over three quarters of these households have been networked within the past two years (see Exhibit 1) illustrates the increasing momentum behind the home networking market. The primary channel for many of the home networking products released in the past two years has been retail, and as the home networking market continues to expand in new directions we will see retailers take an even more active role in promoting home networking and providing consumers with home network solutions. The October 2000 announcement of the formation of the Internet Home Alliance, which was created to educate consumers on the connected home lifestyle and boasts three retailers among its founders, is just one example of increasing retail involvement in this market.

This Report examines the role of electronics and computer retailers in the home networking market, looking specifically at the attributes retailers bring to the market, the reasons behind retailer participation in this market, and the types of products and services retailers will offer to consumers. Finally, this Report profiles specific retailers that are aggressively entering the home networking space.

### Exhibit 1

#### Length of Time Household Has Been Networked

Source: the Yankee Group, 2001



Base = 2.5 million networked U.S. homes.

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### I. Retailer Importance to Home Networking

Retail involvement in the home networking market is critical for a number of reasons. First and foremost, retailers are one of the best **channels to create consumer awareness of home networking** solutions and educate consumers on the benefits of networking. The major electronics and computer retail chains in this country have large and diverse customer bases that they can expose to home networking solutions both in their stores and through advertising campaigns. Retailers spend millions of dollars each year on advertising, and can use this medium to promote home network products and services to the consumer. These companies can leverage their strong brand recognition to create mass-market awareness of home networking and help make consumers comfortable with the concept of networking. Perhaps the most important way in which retailers create consumer awareness of home networking products and solutions will be through their in-store salesforces. If sales staffs are trained effectively, they can help consumers clearly understand the functionality and benefits of specific networked devices and also educate consumers on total home network solutions, which include products and services. By assuming the task of educating consumers, retailers will help consumers make more informed decisions and increase the likelihood of consumer satisfaction with networking. This will be critical to the marketplace since satisfied consumers can then positively influence their friends' and relatives' perceptions of home networking.

Another attribute that the brick-and-mortar retail environment brings to the market is the ability to **allow consumers to experience network-enabled devices**. By visiting a store offering home networking products, consumers will be able to gain a much greater understanding of product functionality. A retail environment offers consumers the chance to test out and gain hands-on experience with network-enabled devices, increasing their comfort level as well as their chances of buying the product.

Retailer participation in the home networking market is not limited to informing consumers about products and selling them these devices. Retailers also have the opportunity to provide consumers network-related services—most importantly, **network installation and maintenance**. Despite the best efforts of companies building home network devices, many of these products are still too complicated for the average consumer to be able to quickly set up a network on his or her own. The idea of having to set up their own network may be daunting to less technically sophisticated consumers, who are not likely to network unless they have a trusted source to handle this for them; a retailer represents such a trusted source. In the future, as network-enabled devices become much easier to set up and connect to a network, installation will still be required for residential gateways (RGs). These devices are likely to become more, rather than less, complex over time. Consumers cannot be expected to set up such complex devices on their own, creating the need for specially trained installers to do such work.

Service providers, the other logical choice for installing network infrastructure, have thus far shown little interest in doing so. Most providers are desperately trying to avoid truck rolls for basic broadband access, and even with home networking and the value-added services that networks and RGs will enable, providers will be reluctant and slow in providing network installation and maintenance. This leaves the field wide open for retailers interested in entering this space. Some retailers already offer installation and maintenance services for other products they sell, such as PCs and home appliances, and therefore moving into home network product installation would be a fairly straightforward exercise.

Finally, retail participation is important to the home networking market because retailers have the ability to **couple home networking gear with related services**. This is especially true when it comes to residential gateways, which will allow retailers to partner with service providers and offer consumers services coupled with this device. This concept of coupling services with devices is not new; it is very similar to what many retailers do today with services such as satellite TV. By partnering with service providers in this fashion, retailers have the opportunity to create consumer awareness of new and value-added services offered by providers that leverage a home network. Service providers, in turn, have the opportunity to capture new revenue streams and new subscribers by using the retail environment to introduce their service offerings to a broader base of consumers. Cellular service providers have experienced a fair amount of success selling service subscriptions together with mobile phones to consumers through such retail arrangements.

## II. What Retailers Stand to Gain

Home networking has gained traction with retailers because these companies view this emerging market as one that will provide them the opportunity to increase revenues and foster better relationships with their customers.

Up to this point, one of the key drivers behind retailer involvement in home networking has been the **compatibility of home networking products with computer and electronics retailers' current product portfolios**. PCs and PC peripherals make up an important product segment for these retailers, which stand to gain from the current spate of home networking kits on the market that allow consumers to network PCs. These kits are another add-on that a retailer can sell to a consumer purchasing a new PC, and also represent a new category of PC peripheral that can draw PC purchasers back into the store at a later date.

In the past 12 months, many retailers have gotten into the business of selling broadband services to consumers via partnerships with broadband service providers (Exhibit 2 details some of these arrangements). Home networking infrastructure increases the value of broadband subscriptions by allowing consumers to share access, so those retailers currently selling broadband subscriptions can provide consumers with a more complete solution by offering home networking products in conjunction with this service.

As home networking capability makes its way into a greater number of products and comes to encompass more systems within the home, many consumers will opt to have home networks installed and configured for them by a network installer, rather than attempting to do this work on their own. **Retailers can assume the role of network**

## Exhibit 2

## Retailer Broadband Partnerships

Source: the Yankee Group, 2001

Retailer	Service Provider	Details of Arrangement
Best Buy	Sprint	Best Buy signs consumers up for fixed wireless service in select cities.
RadioShack	NorthPoint	RadioShack signs consumers up for DSL service.
CompUSA	Comcast/Excite@Home	CompUSA sells modem CPE and self-installation kits for cable modem service.

installer and create new revenue streams for themselves. Retailers are good candidates to create network installer businesses because consumers will be more comfortable with installers they have some experience with. Retailers with strong brands and good reputations for customer service can easily become market leaders in the installation of home networks. Providing installation services for home networks benefits the retailer by allowing it to up-sell additional products once in the consumer's home, as well as selling consumers service contracts related to home networks. Today, retailers make hefty profits on the extended warranties they sell to consumers, and they can offer similar warranty and maintenance contracts on home networks they install. These additional benefits make home networking installation a compelling business for retail chains.

Retailers can also secure additional home networking-related revenue streams by **partnering with service providers to offer consumers home networking services and hardware installation related to these services.** As mentioned earlier, many retailers have already partnered with service providers to allow consumers to subscribe to broadband services and purchase the related customer premises equipment (CPE) in their stores. With home networking, retailers can take these relationships one step further. Retailers will not only be able to partner with service providers to sign up new subscribers for home network-related services and take a cut of revenues generated by these customers; since RGs will be required to support many of these new services, retailers will also be able to make money by assuming the task of installing these RGs at the customer's premises. For service providers looking to avoid truck rolls, outsourcing RG installation to retailers makes a great deal of sense. Some providers may subsidize this installation by paying the retailer a set fee for each install, with retailers passing along the remainder of the cost to the consumer.

By providing a variety of home networking products and services, a retailer has the opportunity to become a provider of complete home solutions to a consumer, allowing the company to **differentiate itself from competitors and increase customer loyalty.** Selling a point product to a consumer gives the retailer little opportunity to add value or ensure that customer will return to buy additional products from that store in the future. In these situations consumers usually gravitate toward the retailer advertising the lowest price on that specific product. By offering total home networking solutions that combine products and services tailored to meet a specific customer's needs, retailers avoid the price wars associated with point products and interact with the consumer on a more personal level, helping them form a relationship with the customer that fosters loyalty within that customer toward the store.